



Remote Monitoring of Pinnipeds in Kenai Fjords National Park

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Biologists conducting long-term population and behavioral field research on animals in the wild often encounter difficulties including inclement weather, provisioning for safety and nutrition, and causing unwanted interactions with the subject animals. Recent technological advancements provide us with tags that track animal movements via radio and satellite transmissions, “critter cams” that record the environment animals inhabit, and other sensors that measure physiological changes over time. Enhanced technology expands parameters that can be measured, but often is limited by small numbers of animals that can be captured and tracked, and the need to handle the animals before they are monitored. The technology is also constrained by sensitivities of the sensors and therefore do not measure the breadth of behaviors most animals exhibit. For animals that congregate for extended periods in predictable locations, the latest

observational technologies have been enhancing traditional population and behavioral methodologies without the need to be present in the field.

Pinnipeds such as Steller sea lions (*Eumetopias jubatus*) and harbor seals (*Phoca vitulina*) haul out to give birth at well-established sites and often in large groups, as they do in Kenai Fjords National Park. In October 1998, the Alaska SeaLife Center (ASLC) contracted with SeeMore Wildlife Systems, Inc. (SWS) of Homer, Alaska, to install remotely-operated cameras at a Steller sea lion rookery on Chiswell Island, which is also a part of the U.S. Fish and Wildlife Service Alaska Maritime National Wildlife Refuge. Six cameras on the island are functional during the breeding season, providing complete coverage of the entire rookery. Each camera is equipped with 12-18 power optical and digital zoom mounted in weatherproof housings and include remotely-controlled pan, tilt, zoom, windshield wiper/washer functions, and a built-in microphone. Audio and video signals are sent via Cat 5

cable to a central control tower on Chiswell Island, which transmits the images and sound to ASLC via microwave transmission. The cameras and control tower are powered by 12-volt batteries that are kept charged by solar panels and wind generators. At ASLC, audio and video signals are viewed and recorded in real time with television monitors, VCRs, and DVD recorders, while commands for controlling the cameras are sent from custom-made software running on a desktop computer. Digital pictures and video are also taken with a click of the mouse and automatically labeled and stored on a computer hard drive. This technology allows us to observe the sea lions in their natural habitat throughout the year without disturbance and without impairment by the extreme weather conditions that often occur in the Gulf of Alaska.

Through subsequent years, remote video studies in Kenai Fjords expanded from the sea lion rookery on Chiswell Island to three nearby sea lion haulouts (resting places with little or no

Figure 1. Sea lions at Chiswell Island.

Photograph by Lauren Washington

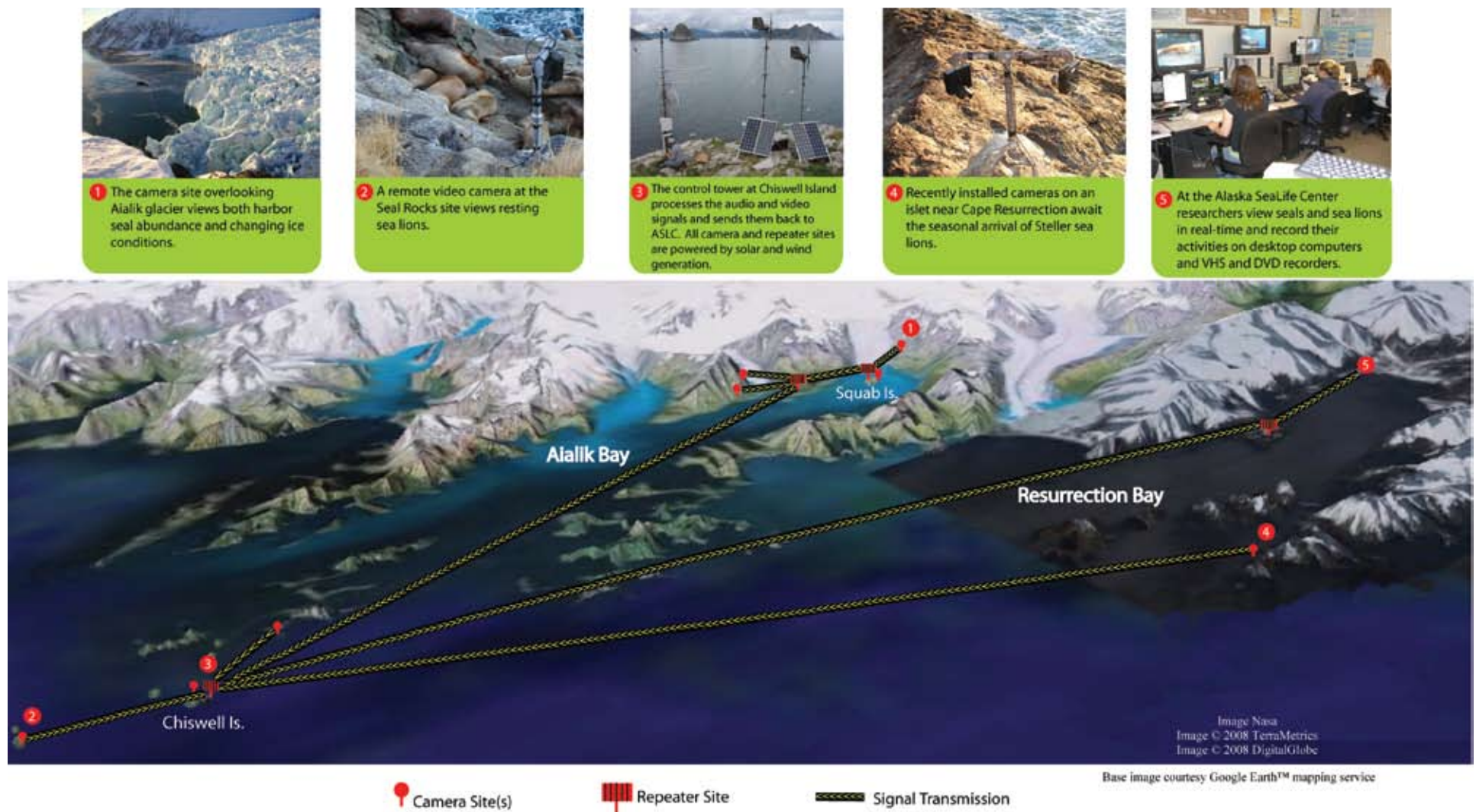


Figure 2. A network of remote signals is transmitted through a hub on Chiswell Island. Audio and video of harbor seals and Steller sea lions are beamed from Chiswell Island through a repeater in Resurrection Bay and back to the Alaska SeaLife Center, where researchers control the cameras and record their observations in real-time from the comfort and convenience of an office setting.

breeding activity) on the outer coast of southcentral Alaska. Remote video studies were further extended to four sites at the head of a neighboring fjord (Aialik Bay) where harbor seals haulout on glacial ice

to give birth, molt, and rest. Studying the different habitats where seals and sea lions aggregate provides an unique opportunity to compare and contrast environmental preferences of these divergent pinnipeds.

Long-distance microwave signals need line-of-sight to be transmitted, which introduces another challenge when working in and around the mountainous terrain of southcentral

Alaska (Figure 2). Therefore, repeater stations at select locations are necessary to send the audio/video signals back to ASLC at the head of Resurrection Bay. We now have in place a complex network of

camera and repeater stations throughout a vast section of Kenai Fjords National Park, giving researchers at ASLC the opportunity to conduct detailed wildlife studies without leaving the comfort and convenience of their office. The repeater network allows for monitoring of full-bandwidth, 30 frame-per-second video on a year-round basis without the cost of paying for bandwidth, which is necessary for a satellite-based system.

Additional remote monitoring equipment that has been used with the current infrastructure includes weather stations, a thermal imaging camera, and hydrophones. Wind speed and direction, barometric pressure, and air temperature are received at ASLC from stations on Chiswell Island and Squab Island in Aialik Bay. Several years of weather data have been recorded from each of those locations and continue to be logged on a daily basis helping us to better understand the microclimatic differences between these adjacent habitats. We have also used a remotely-controlled thermal

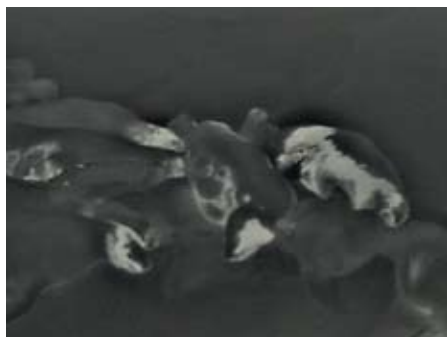


Figure 3. Steller sea lions as seen through a remote video, thermal-imaging camera at night.

imaging camera on Chiswell Island during the summer of 2005 to assess heat loss in Steller sea lions and to conduct observations at night (Figure 3). Hydrophones have been in place at Chiswell Island and in Resurrection Bay to record killer whale (*Orcinus orca*) vocalizations and predation events through various time periods.

Published Results and Ongoing Remote Monitoring Studies

The importance of studying Steller sea lions and harbor seals without disturbance is underscored by their status in this part of Alaska as species that are endangered and of special concern, respectively. Both have experienced population declines of

around 80% since the early 1980s. Our recent studies in Kenai Fjords and others (e.g. Eberhardt *et al.* 2005) are beginning to see slight but promising increases in pinniped numbers in recent years.

At the Alaska SeaLife Center, we have amassed a virtual mountain of data about local pinniped populations in general and the behavior of individual animals since we began our remote monitoring studies in 1998. Individual Steller sea lions are identified by natural scars or circular patches of fungus that grow in their fur and also by brands or tags applied by researchers. Those that have good, reliable markings and are seen consistently at Chiswell Island or other remotely monitored locations are logged



Figure 4. Camera viewing Steller sea lions on Chiswell Island.

in databases and with digital pictures and video. Databases filled with more than 300,000 records on hundreds of recognizable animals have allowed us to examine a wide-range of behavioral parameters concerning reproductive rates, pup mortality, attendance patterns, extent of maternal care (Maniscalco *et al.* 2006), interseasonal and interannual tenure, pupping site fidelity (Parker *et al.* In Press), unusual behaviors such as care of non-filial young (Maniscalco *et al.* 2007a), and a singular occurrence of live-born twins.

The pupping period for Steller sea lions lasts from late May until early July with a peak during the second week in June each year. We have found that reproductive rates among individuals at Chiswell Island are at least 75%, meaning that reproductively mature females will give birth in three out of every four years. However, we have observed that at least four females in particular have given birth every year over seven consecutive years. Others have not been so prolific. These types of data are extremely important in determining the potential of populations to recover from major losses such as the Steller sea lion has seen.

Once pups are born, their mothers stay on shore guarding and nursing them for about 10 days (termed the perinatal period) before they return to a cycle of feeding at sea and nursing their pups on shore (Maniscalco *et al.* 2006). During the perinatal period, pups are vulnerable to being trampled by adult sea lions or more commonly, washed away by heavy surf during occasional summer storms. Researchers typically are unable to

Photograph by Elizabeth Moundaleis



Photograph by Jill Prewitt

Figure 5. Harbor seal on glacial ice.

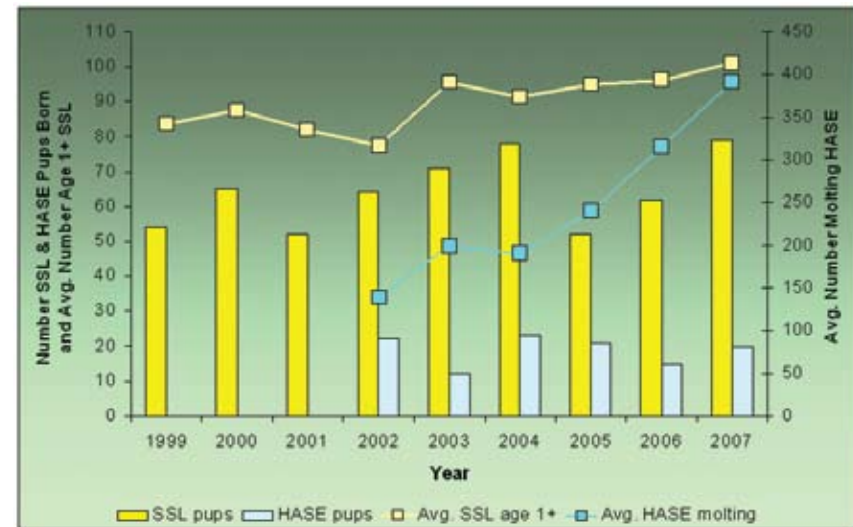


Figure 6. Recent population trends of Steller sea lions (SSL) and harbor seals (HASE) at Chiswell Island and Aialik Bay. The left axis represents the number of pups born and the average number of sea lions older than one; the right axis represents the average number of harbor seals during the molting axis.

conduct field observations during extreme storms in places like the Gulf of Alaska. Observations of this type are not a problem using a remote video monitoring system, and therefore we are able to obtain a more accurate picture of important parameters in wildlife population dynamics such as pup mortality (Figure 4). Our long-term studies using the remote video system on Chiswell Island indicate that approximately 6% of the pups born are lost to high surf conditions and inattentive mothers, another 8% die from a variety of factors including starvation after maternal abandonment and killer whale predation.

By late summer, we have observed that lactating females spend much greater time foraging at sea compared to earlier in the season (Maniscalco *et al.* 2006), while the pups are spending more time in the water

near shore playing and learning to swim. That is the time when killer whales may visit the rookery in search of an easy meal. During 2001, a lone female killer whale preyed upon an estimated 12 pups and returned two years later with another female and a year-old calf that was apparently being trained to prey upon sea lions (Maniscalco *et al.* 2007b).

The number of Steller sea lion pups born at Chiswell Island since 1999 has shown no significant up or downward trend but perhaps a cyclic pattern (Figure 6). On the other hand, the numbers of adult and juvenile sea lions using Chiswell Island has increased modestly but significantly during that same time period. These data suggest the possibility of greater survivorship with no overall change in fecundity.

Research on harbor seals using

glacial ice habitats takes advantage of the flexibility of camera control to observe animals in constant motion. Seals that ride on top of ice calved from Aialik Glacier may travel more than five miles during the day. Cameras located on top of Squab Island provide a central location from which to count seals circling the island while cameras above Aialik and Pedersen Glaciers provide insight into glacial activity and the glacial face environments that are too dangerous for humans to explore (Figure 5). Since observations began in 2002, numbers of pups born near Aialik Glacier have been similar from year to year, but remain at low levels, about 20% of the numbers counted in 1980. Conversely, numbers of seals counted during the molt, have rapidly increased at a rate of about 20% annually (Figure 6). Most of that increase is associated with newly created habitat in Pedersen Lake, expanding through the recession of Pedersen Glacier.

The physical properties of the fjords and adjacent Harding Icefield generate microclimates that influence the

weather affecting the animals we observe. The atmosphere over the Harding Icefield often is higher pressure than surrounding regions in the Gulf of Alaska. For that reason, the predominant breezes in the upper fjords reflect the flow of air from the Harding Icefield toward the Gulf of Alaska. During the summer, adiabatic winds created from the heating of land masses, generate southerly “bay breezes” in the afternoons. Weather systems in the Gulf of Alaska affect locations outside the protection of the fjords. Weather stations located on the Harding Ice field (NPS), upper Aialik Bay (ASLC), Pilot Rock in lower Resurrection Bay (National Weather Service), and on Chiswell Island (ASLC) provide means for contrasting microclimates within fjord systems (Figure 7).

Video from Chiswell Island is broadcast on a local television station in Seward, Alaska, and over the internet providing real-time views of Steller sea lions throughout the world. Visit www.alaskasealife.org for the video link; more information can also be found at www.seemorewildlife.com

Regional Frequency Distribution of Wind Speed and Direction.

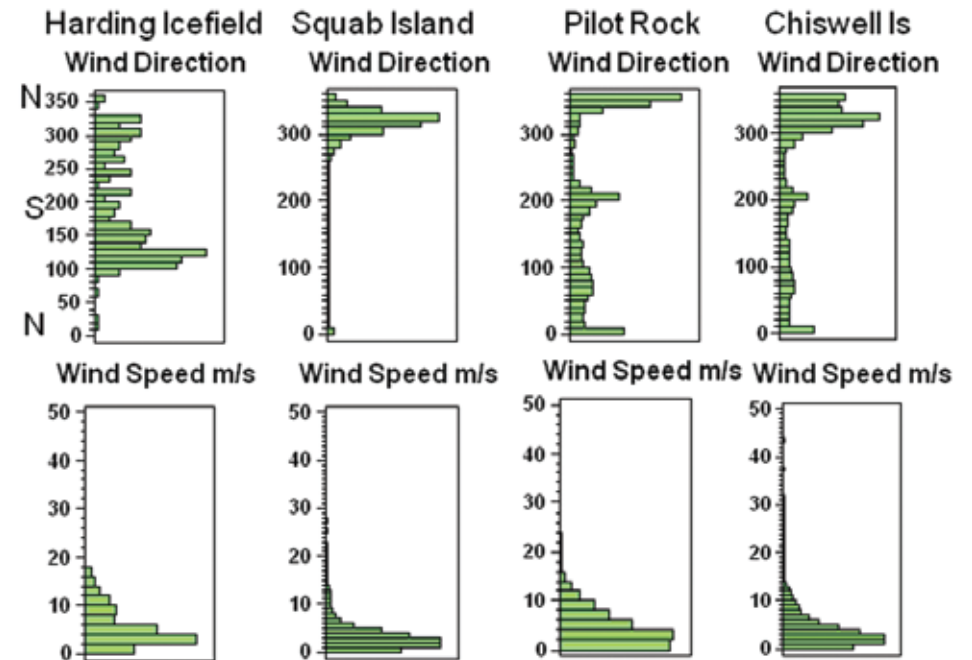


Figure 7. Regional frequency distribution of wind speed and direction in Kenai Fjords National Park.

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